

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

STRUCTURE FOR WATER CONTROL

(no.)

CODE 587

DEFINITION

A structure in an irrigation, drainage, or other water management systems that conveys water, controls the direction or rate of flow, or maintains a desired water surface elevation.

SCOPE

This standard applies to the structures normally installed in a well-planned irrigation or drainage system, wildlife facility or other water management systems for the conveyance, flow control, or level regulation of water. It covers the planning and functional design of such water-control structures but not the detailed design criteria or construction specifications for specific structures. It does not apply to structural components of irrigation pipelines or to subsurface drains or grade-stabilization structure (410).

PURPOSE

To control the stage, discharge, distribution, delivery, or direction of flow of water in open channels or water use areas. Also used for water quality control, such as sediment reduction or temperature regulation. These structures are also used to protect fish and wildlife and other natural resources.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies wherever a permanent structure is needed as an integral part of an irrigation, drainage, or other water-control systems to serve one or more of the following

functions:

1. To conduct water from one elevation to a lower elevation within, to, or from a ditch, channel, or canal. Typical structures: drops, chutes, turnouts, surface water inlets, head gates, pump boxes, and stilling basins.
2. To control the elevation of water in drainage or irrigation ditches. Typical structure: checks.
3. To control the division or measurement or irrigation water. Typical structures: division boxes and water measurement devices.
4. To keep trash, debris, or weed seeds from entering pipelines. Typical structure: debris screens.
5. To control the direction of channel flow resulting from tides and high water or backflow from flooding. Typical structure: tide and drainage gates.
6. To control the level of a water table or to remove surface or subsurface water from adjoining land, to flood land for frost protection or to manage water levels for wildlife or recreation. Typical structures: water level control structures, pipe drop inlets, and box inlets.
7. To provide water control for recreation or similar purposes.
8. To convey water over, under, or along a ditch, canal, road, railroad, or other barriers. Typical structures: bridges, culverts, flumes, inverted siphons.
9. To modify water flow to provide habitat or fish, wildlife, and other aquatic animals. Typical structures: deflectors, chutes, cold water release, or structures to make pools and riffles.

DESIGN CRITERIA

Structures shall be designed on an individual job basis, or applicable SCS standard drawings shall be adapted, to meet site conditions and functional requirements. They shall be part of an approved and overall engineering plan for irrigation, drainage, wildlife, recreation, channel improvement, or similar purposes.

The plan shall specify the location, grades, dimensions, materials, and hydraulic and structural requirements for the individual structure. Provisions must be made for necessary maintenance. Care must be used to insure that the area's visual resources are not damaged. If watercourse fisheries are important, special precautions or design features may be needed to insure continuation of fish migrations.

If soil and climatic conditions permit, a protective cover of vegetation shall be established on all disturbed earth surfaces. If soil or climatic conditions preclude the use of vegetation and protection is needed, non-vegetative means, such as mulches or gravel, may be used. In some places, temporary vegetation may be used until permanent vegetation can be established. The structure can be fenced, if necessary, to protect the vegetation. Seedbed preparation, weeding, fertilizing, and mulching shall comply with the instructions in technical guides.

DESIGN DISCHARGE

The pipe conduit shall be designed so that its capacity when combined with emergency spillway discharge or flood storage, or both, shall be adequate to prevent overtopping of the supporting earth embankments.

When the purpose of the structure is to control a drop at the end of a drainage ditch, the conduit shall be designed to carry a runoff 25 percent greater than the design capacity of the channel

in which it is placed.

SEEPAGE CONTROL

Seepage control will be provided for pipes over 30 inches in diameter. Seepage along pipes shall be controlled by use of a filter and drainage diaphragm, unless it is determined that anti-seep collars will adequately serve the purpose. Seepage control shall be designed in accordance with the requirements for Ponds (378).

Anti-vortex Baffles

An anti-vortex baffle should be used if the maximum depth of flow over the lip of the riser is expected to exceed one-half the diameter of the riser pipe.

Outlet Treatment

Where structures, without detention storage, discharge onto non-cohesive soils, pipe outlets may require protection to prevent undermining of the structure. Refer to Ponds (378).

Embankment

Embankment for structure for water control shall be designed to fit existing site conditions, shall meet the requirements of Ponds (378), and shall meet the following requirements.

1. For pipe overfall structures, the combined upstream and downstream side slopes of the settled embankments shall not be less than 5 horizontal to 1 vertical. The top width of the fill shall be at least 6 feet and shall be increased in proportion to the fill height so that at least two-thirds of the pipe is covered with fill material.
2. For pipe drop inlets used to control a vertical drop into a drainage channel or waterway, the combined upstream and downstream side slopes of the settled embankments shall not be less than 5 horizontal to 1 vertical, and neither slope shall be steeper than 2 horizontal to 1 vertical. The top width of the fill shall be in accordance with Pond 378.

Emergency Spillway

All structures shall have an emergency spillway to prevent overtopping of the support fill; except in flat land areas where adequate temporary storage is provided to prevent overtopping. The spillway shall be designed to carry the difference between the runoff expected from the design storm and the capacity of the structures.

The design storm shall be at least a 10-yr. frequency storm for structures designed to carry a runoff 25 percent greater than the design capacity of the channel in which it is placed. The design storm of other structures shall be at least a 25-yr. frequency storm.

PLANNING CONSIDERATION

Food Security Act, Swampbuster, and Section 404 of the Clean Water Act provisions must be considered prior to providing assistance.

Water Quantity

1. Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
2. Potential for a change in the rate of plant growth and transpiration because of changes in the volume of soil water.
3. Effects on downstream flows or aquifers that would affect other water uses or users.
4. Effects on the volume of downstream flow that might cause environmental, social or economic effects.
5. The effect on the water table of the field to ensure that it will provide a suitable rooting depth for the anticipated crop.
6. Potential use for irrigation management to conserve water.

Water Quality

1. Effects on erosion and the movement of sediment and soluble and sediment-attached substances carried by runoff.
2. Effects on the movement of dissolved

substances below the root zone and to ground water.

3. Short term and construction-related effects of this practice on the quality of downstream water.
4. Effects of water level control on the temperatures of downstream waters for their effects on aquatic and wildlife communities.
5. Effects on wetlands or water-related wildlife habitats.
6. Effects on the visual quality of downstream water resources.

PLANS AND SPECIFICATIONS MATERIALS

The plans shall specify the size, kind, length, gate, finish or coating, type of grade of pipe to be used. Specified materials shall be of a quality capable of providing the stability and durability required to achieve the planned objective with appropriate factors of safety.

Standard corrugated metal pipe with standard band couplers may be used for pipe overfall structures. When corrugated metal pipe is used for pipe drop inlet structure, it shall be of lock seam, or close riveted construction with watertight couplers if the pipe will be under significant pressure.

INSTALLATION GENERAL

The installation of the pipe, risers, couplings, and diaphragms shall be in accordance with manufacturer's recommendations and as shown on the plans.

All corrugated metal pipe shall be laid with the outside circumferential joints pointing upstream and with the longitudinal laps at the sides at above the vertical mid-height of the pipe.

PIPE OVER-FALL STRUCTURE

The pipe shall be installed in a structure trench,

excavated in undisturbed material. The trench shall not be less than 12-inches nor more than 24-inches wider than the diameter of the pipe. Backfill shall be accomplished as outlined under “Back-filling” in this specification.

PIPE DROP INLET-STRUCTURE

The pipe shall be installed in a structure trench, excavated in undisturbed or semi-compacted material. The trench shall not be less than 12-inches nor more than 24-inches wider than the diameter of the pipe. Where the ground line is such that the trench cannot be excavated in undisturbed material, the area shall be filled with semi-compacted fill to an elevation of at least two feet above the planned elevation of the crown of the barrel prior to excavating the structure trench. The pipe shall then be installed and back fill accomplished as hereinafter specified.

REPAIR OF COATINGS

The pipe, fittings, and appurtenances will be transported and handled in such a manner as to prevent brushing, scaling, or breaking of galvanized or coatings. After the pipe and fittings have been completely installed and while still exposed, any damaged areas where the coating has been broken sufficiently to expose the base metal shall be remedied by re-coating with a material similar and equal to the original coating.

BEDDING

The bottom of the trench or excavation shall be molded to fit the outer circumference of the pipe in such a manner that the depth of the molded bed shall be a minimum of one-tenth times the outside diameter of the pipe below the level of the original bottom of the trench. The pipe shall be bedded on approximately 1-½ inches of moist, loose, well-pulverized soil material for the entire length of the molded bed. The trench bottom shall be free of sod, stumps, roots,

boulders or rock, and frozen earth.

BACK-FILLING

The materials for back filling shall be obtained from required excavation or material available at the site and shall be similar to the material of the trench bottom. The back-fill material shall be free of sod, roots, hard lumps or clods, rocks larger than three inches in diameter, frozen material or earth containing a high percentage of organic material.

Back-fill under the haunches and around the pipe shall be accomplished by placing and thoroughly tamping layers of maximum 6-inches thickness or alternate sides so as to keep the same elevation on both sides of the pipe at all times. Care must be exercised during back-fill to assure that the pipe is not displaced. The tamping may be accomplished with hand or mechanical equipment. Heavy equipment or loads shall not be allowed to pass over the pipe until at least 2 feet of fill has been placed and tamped over the top of the pipe.

CONCRETE

The concrete required at the base of the risers or at the other locations as shown on the drawings shall be composed of Type I, Portland Cement, sand, coarse aggregate, and water. The cement content of the concrete shall not be less than five sacks per cubic yard. The aggregate composed of sand and gravel, shall consist of tough, hard, durable particles, free of organic matter or other objectionable material, having a maximum size of 1 ½ inches and not more than 5 percent passing a No. 200 sieve. The weight of fine aggregate shall not be less than 250 pounds and combined aggregate shall not be more than 660 pounds per sack of cement. Allowable slump shall be 2 to 4 inches.

EARTHWORK

The earth-fill and emergency spillway will be

constructed to the elevations, slopes, and dimensions shown on the plans. Vegetative treatment shall be carried out as shown on the plans.

CHECKING FOR COMPLETION

Structures for Water Control shall be checked for completion in accordance with procedures given in TR-62, Note-keeping Instruction for Engineer Practices.